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[redacted]

ELECTRONICS TECHNICIAN EXAMINATION

AC Circuits

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Date FEB-28-1957 (8P)

100% CORRECT BY. Sam Lew.

Multiple Choice--Circle the most correct answer.

1. The current through a pure inductance:
   a. is in phase with the voltage across the inductor.
   b. is of opposite phase to the voltage across the inductor.
   c. leads the voltage across the inductor by 90 degrees.
   [✓ d.] lags the voltage across the inductor by 90 degrees.

2. The current through a pure capacitance:
   a. is in phase with the voltage across the capacitance.
   b. is of opposite phase to the voltage across the capacitor.
   [✓ c.] leads the voltage across the capacitor by 90 degrees.
   d. lags the voltage across the capacitor by 90 degrees.

3. The current through a pure resistance:
   [✓ a.] is in phase with the voltage across the resistor.
   b. is of opposite phase to the voltage across the resistor.
   c. leads the voltage across the resistor by 90 degrees.
   d. lags the voltage across the resistor by 90 degrees.

4. If the frequency of the voltage applied to a capacitor is increased, the capacitive reactance:
   a. increases.
   [✓ b.] decreases.
   c. remains the same.

   $X_c = \frac{1}{\omega F}$

5. If the frequency of the voltage applied to an inductor is decreased, the inductive reactance:
   a. increases.
   [✓ b.] decreases.
   c. remains the same.

   $X_L = \omega L$

6. If the frequency of the voltage applied to a pure resistance is increased the opposition offered to the flow of current:
   a. increases.
   b. decreases.
   [✓ c.] remains the same.

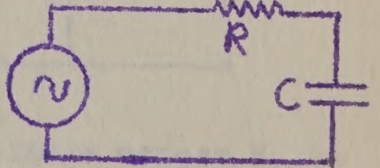


Fig.1

7. Referring to fig. 1, if R is equal to X_c:
   a. the voltage across C leads E app. by 45 degrees.
   [✓ b.] the voltage across C lags E app. by 45 degrees.
   c. the voltage across C lags the voltage across R by 45 degrees.
   d. the voltage across C leads the voltage across R by 45 degrees.

8. Referring to fig. 1, if R is ten times greater than X_c:
   [✓ a.] the voltage across R is almost in phase with E app.
   b. the voltage across C is almost in phase with E app.
   c. the voltage across R leads E app. by almost 90 degrees.
   d. the voltage across R lags E app. by almost 90 degrees.

Examination--Part II--AC Circuits

9. Referring to fig. 1, if X_c is ten times greater than R:
   a. E app. is almost in phase with the voltage across R. x
   b. the current flow through C is in phase with the voltage across C. x
   [✓ c.] the current flow through R is in phase with the voltage across R.
   d. the current flow through R ~~is in phase~~ leads the current flow through C by 90 degrees.

10. Referring to fig. 2, if R is equal to X_L:
   ✓ [✓ a.] The voltage across L leads E app. by 45 degrees.
   b. the voltage across L lags E app. by 45 degrees. x
   c. the voltage across L lags the voltage across R by 45 degrees.
   d. the voltage across L leads the voltage across R by 45 degrees.

11. Referring to fig. 2, if R is ten times greater than X_L:
   a. the voltage across L is almost in phase with E app. x
   [✓ b.] the voltage across R is almost in phase with E app.
   c. the voltage across R leads E app. by almost 90 degrees.
   d. the voltage across R lags E app. by almost 90 degrees.

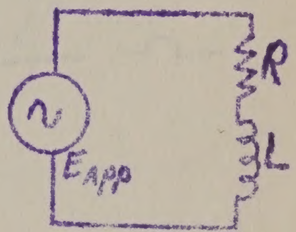


Fig. 2

12. Referring to fig. 2, if X_L is ten times greater than R:
   a. E app. is almost in phase with the voltage across R.
   b. the current flow through L is in phase with thevoltage across L.
   c. the current flow through R leads the voltage across R by 90 degrees.
   [✓ d.] the voltage across L leads the voltage across R by almost 90 degrees.

13. Referring to fig. 3, if X_c is equal to X_L:
   a. the voltage across L is in phase with E app. x
   [✓ b.] the voltage across R is in phase with E app.
   c. the voltage across C is in phase with E app. x
   d. None of the above answers is correct.

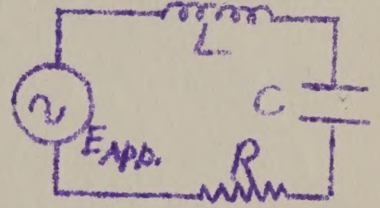


Fig. 3

14. Referring to fig. 3, if X_L equals 10K, X_c 10K, and R 10K, the total impedance is:
   a. 30K
   b. 24.14 K
   [✓ c.] 10K
   d. 0

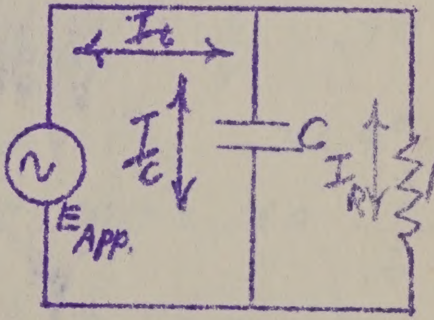


Fig. 4

15. Referring to fig. 4, if X_c is equal to R:
   [✓ a.] I_r lags I_t by 45 degrees. x
   b. I_r leads I_c by 90 degrees. x
   c. I_r leads I_t by ~~mx~~ 45 degrees. x
   d. I_c lags I_r by 90 degrees.

16. Referring to fig. 4, if X_c is ten times greater than R:
   a. the voltage across C is ten times greater than the voltage across R. x
   [✓ b.] the voltage across C is in phase with the voltage across R. x
   c. the current flow through C is in phase with the current flow through R. X
   d. the current flow through C lags the current flow through B by almost 90 degrees.

17. If an a-c voltage of 15 KC is applied to a coil having an inductance of 65 millihenries, what is the inductive reactance of the coil? 6123 Ω

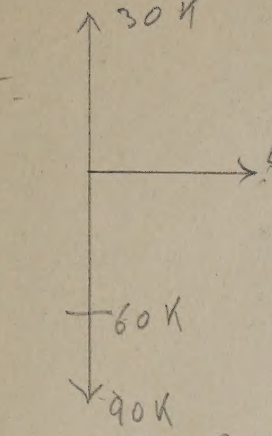
$X_L = 2\pi FL = 6.28 \times 15 \times 10^3 \times 6.5 \times 10^{-2} = 6123\ \Omega$

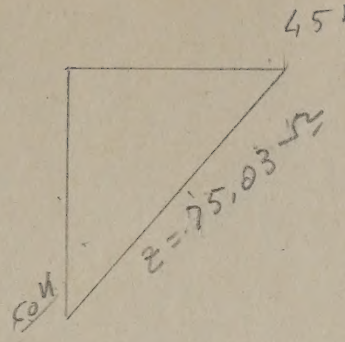
18. Two capacitors, .1mfd and .25 mfd, are connected in series in a circuit to which an a-c voltage of 5 KC is applied, what is the total reactance of the circuit?

$\frac{1}{\frac{1}{.1}+\frac{1}{.25}} = .071$ MFD

$X_C = \frac{1}{2\pi FC} = \frac{1}{6.28 \times 5 \times 10^3 \times 7.1 \times 10^{-8}} = 448\ \Omega$

1 –





TANG. = $\frac{60}{45}$ = 1.33

θ = 53.1°

SINE 53.1° = .7997 = $\frac{60}{Z}$

60 : .7997 = 75.03 KΩ

Z = 75.03 ∠−53.1° Ω

22

90 − 60 = 30

23 = ~~E_R LEADS BY 53.1~~

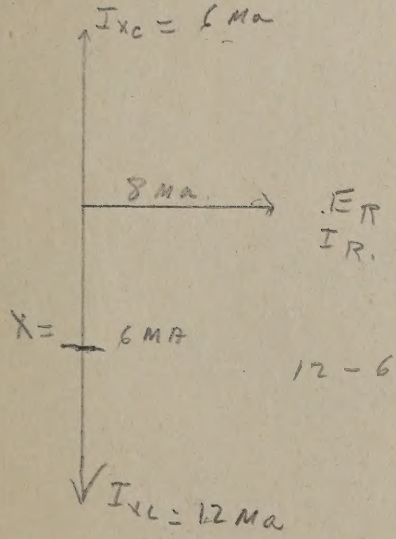
24. I_R = 120 ÷ 15 × 10^3 = .008 AMP.

I_{X_C} = 120 ÷ 20 × 10^3 = .006 AMP

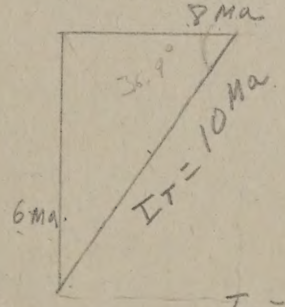
I_{X_L} = 120 ÷ 10 × 10^3 = .012 AMP.

25

26



12 − 6 = 6 ma



TANG = $\frac{6}{8}$ = .75

TANθ .75 = −36.9°

SINE 36.9° = .60 $\frac{6}{I_T}$

I_T = $\frac{6 \times 10^{-3}}{.60}$ = 10 ma

I_T = 10 ∠−36.9 Ma

Z = $\frac{120}{.010}$ = 12 K.

19. Referring to fig. 5, if X_L is ten time greater than R:
c [✓ a.] the current flow through R is ten times greater than through L.
b. the current flow through L leads the current through R by 90 degrees. x
c. the voltage across L leads the voltage across R by 90 degrees.
d. the current flow through L is in phase with the current through R. x x

20. Referring to fig. 5, if X_L is equal to R;
[✓ a.] the current flow through L lags the current through the generator by 45 deg
b b. the voltage across L leads the voltage across ~~thexxgen~~ R by 90 degrees.
c. the voltage across L leads the voltage across the generator by 45 degrees.
d. the current through L is in phase with the current through the generator.

c 21. Referring to fig. 6, calculate the total impedance of the circuit. Z = 75.03 K-Ω

c 22. Referring to fig. 6, what is the phase angle between the voltage across R and the applied voltage? Does E_r lead or lag E app.?
E = 150 ∠-53.1° E_R LEADS.

c 23. Referring to fig. 7, calculate the total current flowing in the circuit.
I_T ∠ 10 ma

c 24. Referring to fig. 7, calculate the total impedance of the circuit.
Z = 12 K.

c 25. Referring to fig. 7, calculate the phase angle between the current flowing through R and the total current. I_R LEADS I_L BY -36.9°
-~~33~~°

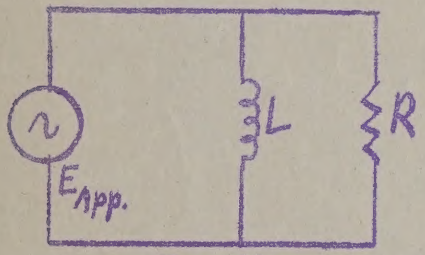
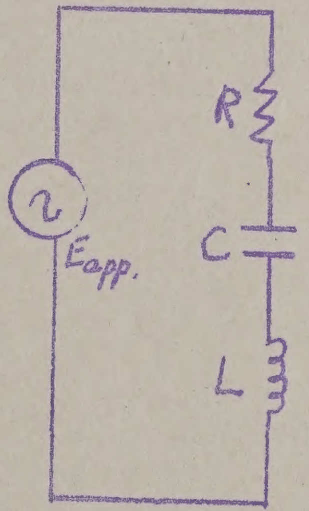


Fig. 5



R = 45K
X_C = 90K
X_L = 30k
E_{App} = 150 volts

Fig. 6

Z = 75.03 K-Ω

Z = 75.03 K-Ω ∠-53.1°

ER LEADS E BY ∠53.1°

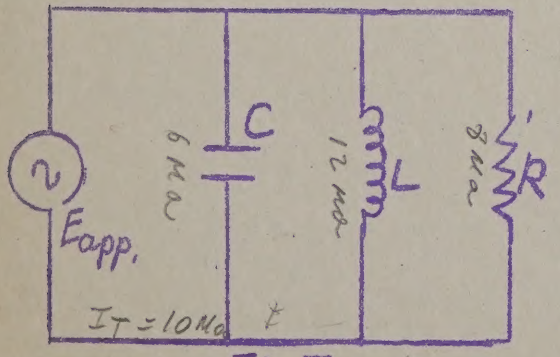


Fig. 7

R = 15K
X_C = 20K
X_L = 10K
E app = 120 volts

I_T = 10 ma ∠-36.9°

Z = 12 K ∠36.9°